Application of Lean principles can reduce inpatient prescription dispensing times

By Jon Beard and Damian Wood

In early 2008 the pharmacy department at Musgrove Park Hospital (a district general hospital in Taunton, Somerset, and part of the Taunton and Somerset NHS Foundation Trust) was experiencing delays to inpatient dispensing. These delays were becoming more acute because of an increasing dispensing workload which was projected to rise by 20 per cent by the end of the year.

By November 2008, dispensary staff had to work and diligence) had been marginally effective but difficult to sustain. By early 2008, median prescription times (the time taken to dispense an item once received in the dispensary) exceeded three hours and daily dispensing times were highly variable. This situation developed despite the partial automation of the dispensary in October 2006 with the introduction of two dispensing robots.

The decision to begin a project to reduce waiting times in June 2008 was made after the chief pharmacist attended a five-day course focusing on improving clinical systems using a range of Lean and other techniques. The principal aim was to reduce average inpatient prescription dispensing times to less than one hour without increasing staffing levels, dispensing error rates or adversely affecting patient safety. The secondary aim was to be able to close the pharmacy at 5.30pm each weekday.

Method

The project was regarded as an audit of current dispensary practices and, therefore, ethical approval was not required. All relevant staff were briefed about the intended aims of the project and about how it would be approached and then relevant staff were recruited. Baseline data were collected. Average daily prescription times were obtained automatically from the legacy stock control system and plotted on a chart. These data were then used as the main indicator of progress of the project. Reported dispensing errors were already being monitored routinely via the trust’s clinical incident reporting system.

A process map of the entire dispensing process and associated activities was then constructed. This involved describing the journey of a single prescription in detail, starting at the point it was written by the prescriber and ending when the dispensed item arrived on the ward to be put away by nursing staff in the correct location (Panel 1). Staff who participated in constructing the process map were encouraged to describe what actually happened in practice. No reference was made to any existing standard operating procedures. Any identified waiting times were regarded as a defined step in the overall process. Related “sideline” processes were also mapped. These included how the dispensary was opened each day and how activities such as stock rotation, stock issues, compliance aid preparation and Controlled Drug dispensing were integrated into the daily dispensary routine. The process map focused on the main workload of the dispensary, which was straightforward original pack dispensing.

The capacity of each step in this process map (how often the step could be undertaken per unit time) was estimated. The purpose was to identify any capacity mismatches between concurrent steps and hence bottlenecks or impediments to efficient working.1

The resulting process map was then further evaluated by value mapping2 and failure mode and effects analysis.

Value mapping Value mapping involved scrutinising each step in the process and asking why it was necessary to perform that step and whether it could be done differently or removed from the process. The chief pharmacist acted as the group member asking the questions. This served two purposes: it brought the group together reliably and also reduced the tendency of others within the group to avoid answering questions that were potentially professionally challenging. When apparently unnecessary steps were identified, they formed the basis of some of the subsequent tests of change.

Failure mode and effects analysis Failure mode and effects analysis (FMEA) was undertaken after completion of the process map. Each process step was reviewed in terms of reliability and the consequences of it failing. A full FMEA was not undertaken, but the principles behind the technique were used to identify less safe and unreliable practice with a view to performing tests of change.

In this way a variety of ‘wasteful’ or unnecessary steps within the process were identified. These included unnecessary waiting and prioritisation, avoidable interruptions, batching and capacity mismatching. Further consideration was given to these factors and a list of proposed changes were developed.

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Abstract

Aim

To reduce average inpatient prescription dispensing times to less than one hour without increasing staffing levels, dispensing error rates or adversely affecting patient safety in any way.

Design

Process and value mapping, capacity estimation and failure mode effect analysis of current processes.

Setting

Pharmacy department of Musgrove Park Hospital, part of the Taunton and Somerset NHS Foundation Trust.

Outcome measures

Reduced dispensing times, patient and nursing staff satisfaction.

Results

Median dispensing times fell from 188min to 27min (standard deviation, 7min) and were sustained thereafter. 65% of daily work was completed before 1pm. The dispensary closed consistently at 5.30pm Monday to Friday. Reported dispensing error rates remained unchanged.

Conclusion

Simple interventions designed to reduce wasteful activity and increase workflow can reduce dispensing times consistently without increasing staff or adversely affecting patient safety.
These proposed changes were intended to minimise the impact of factors identified as contributing to long dispensing times.

The impact of each proposed change was then assessed in a controlled way using the technique of “plan, do, study, act” (PDSA) rapid cycle tests of change. The results of the tests were documented and objectively assessed by the group. Successful tests of change were immediately implemented. Unsuccessful tests were abandoned. This testing process soon revealed a range of useful visual key performance indicators (KPIs) that became used to supervise dispensary processes (Panel 2). These KPIs were incorporated into routine dispensary supervision and used to give dispensary staff immediate feedback on how the modified process was performing at any given time.

The impact of implementing the changes (Panel 3) was monitored through daily average dispensing times that in turn were plotted on charts together with daily workload statistics. Eventually they formed process control charts amenable to statistical analysis. Following implementation of successful changes the “new” dispensing process was significantly different (Panel 4).

Results
Following process changes, baseline median dispersions times fell from 188 minutes to 27 minutes (standard deviation = 7 min) in a stepwise fashion (Table 1) and were sustained thereafter. Sixty-five per cent of daily work was completed before 1 pm. The dispensary closed at 5.30 pm on Mondays to Fridays. No dispensing errors were reported.

Discussion
These results were obtained while the overall dispensing workload was significantly higher. There was no appreciable increase in departmental costs as a consequence of making these changes. One small cost included the acquisition of a telephone answering machine. The project has resulted in staff cost savings as the need to pay overtime or award overtime was dispelled. Some pharmacists were initially unwilling to send incomplete prescriptions to the ward or prescriber. This test was found to be successful with 65% of daily work completed before 1 pm. The dispensary now closes at around 5.30 pm.

The dispensing function is performed and three pharmacies occupy the three dispensing stations from 8.30 am.

When prescriptions were placed in the “in” tray, a pharmacist promptly clinically checks them and immediately logs them onto the tracking system. This continues until the tray is empty.

The dispensing function is performed and three pharmacies occupy the three dispensing stations from 8.30 am.

<table>
<thead>
<tr>
<th>Panel 1: A prescription’s journey</th>
</tr>
</thead>
<tbody>
<tr>
<td>A medicine would be prescribed on the medicines administration record (MAR): ( C = 0.25 ) per minute. In practice many prescriptions would be written prescriptions at approximately the same time.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel 2: KPIs</th>
</tr>
</thead>
<tbody>
<tr>
<td>The following is a list of simple key performance indicators of how the dispensary is working:</td>
</tr>
</tbody>
</table>

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The introduction of changes posed few problems. The main challenge was trying to change pharmacy staff behaviour and beliefs. Many staff initially believed that no improve-
possible and indeed desirable to re-allocate dispensing staff to other activities in the afternoons. It is now easier to allow staff to take time off in the afternoons when requested. Further work is required to address the continuing problem of when exactly to dispense compliance aids and Controlled Drugs.

Conclusion
This project demonstrates the usefulness of using established, industrial change management techniques to assess systems and processes in a healthcare environment.

References

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Panel 4: The current dispensing process
- Dispensing starts promptly at 8.30am with the arrival of prescriptions collected by the porter.
- The optimal number of staff is currently one pharmacist, three dispensers, an accredited checking technician and one or two assistants processing stock requests.
- Two pharmacy assistants visit all wards to collect any outstanding prescriptions and return 20 minutes later.
- Prescriptions are promptly clinically checked and logged on in the order they arrive.
- Problem prescriptions are sent back to wards or put to one side to await some form of enquiry from wards.
- Compliance aid prescriptions are put to one side to be processed in the afternoon.
- The robot is kept functioning, ideally by three dispensers, at all times.
- At 9am a second pharmacist arrives to assist for one hour because this is now the busiest time of day.
- Work continues with staff breaks being staggered at the discretion of the dispensary supervisor, who monitors activity using key performance indicators.
- By 1pm, approximately 65 per cent of the day’s dispensing work is complete.
- Between 3pm and 3.30pm the dispensary manager assesses whether dispensary staff can be reassigned to other duties or activities.
- At 4pm the on-call pharmacist arrives in the dispensary.
- At 5pm the “late night” pharmacist arrives to work with the on-call pharmacist and the dispensary staff leave.
- At 5pm one or two “late” technicians join the dispensary.
- The dispensary aims to close at 5.30pm.

Equally it demonstrates that implementing simple, structured changes aimed at improving workflow and removing wasteful activities can be highly effective in reducing long dispensing times in an acute hospital dispensary without increasing staffing levels or compromising patient safety.

Acknowledgements
We thank Christine Hart and the dispensary staff of Taunton & Somerset NHS Foundation Trust for their willing support and co-operation during this project. We also thank Paul Blew for technical support.

Table 1: Statistical process control (SPC) analysis of dispensing times between January 2008 and August 2009 — data calculated using a commercial SPC programme

<table>
<thead>
<tr>
<th>SPC step &amp; time period</th>
<th>Median value (min)</th>
<th>SD (min)</th>
<th>Upper control limit (min)</th>
<th>Lower control limit (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (1/1/8-4/5/8)</td>
<td>188</td>
<td>77.1</td>
<td>419.4</td>
<td>0</td>
</tr>
<tr>
<td>B (6/5/8-1/7/8)</td>
<td>136.9</td>
<td>47.2</td>
<td>278.4</td>
<td>0</td>
</tr>
<tr>
<td>C (1/7/8-2/10/8)</td>
<td>89</td>
<td>24.9</td>
<td>163.7</td>
<td>14.2</td>
</tr>
<tr>
<td>D (2/10/8-14/11/8)</td>
<td>63</td>
<td>19.5</td>
<td>121.4</td>
<td>4.6</td>
</tr>
<tr>
<td>E (14/11/8-3/8/9)</td>
<td>26</td>
<td>5.5</td>
<td>42.5</td>
<td>9.5</td>
</tr>
</tbody>
</table>

Key: A = pre-intervention baseline data (the results of “professional autonomy”); B = unstructured intervention (the encouragement of increased “hard work and diligence”); C = all major interventions implemented excluding formal supervision; D = key performance indicator (KPI)-guided supervision maintained until mid morning each day; and E = KPI-guided supervision maintained for most of each day. Staff were trained in the new system after this step. The impact of training was to increase the number of trained supernumeraries to oversee the new process.

Panel 3: Changes made to the dispensing procedures
- A blue tray was introduced on all wards to act as a pick up and drop off point for prescriptions and medicines deliveries. This removed the need to look for or ask for prescriptions or to ask nursing staff to take receipt of most medicines.
- A porter collected prescriptions from all wards and delivered them to the pharmacy at 8.30am on weekdays. The result of this change was that the dispensing of large numbers of prescriptions could start at 8.30am.
- Further changes to the porter delivery schedule increased the number of deliveries to the whole hospital from 3.5 to 4.5 deliveries per day.
- Two pharmacy assistants began visiting all wards from 8.30am to pick up remaining prescriptions from wards.
- Dispensary pharmacists would arrive in the dispensary promptly at the scheduled time and clinically check all prescriptions as their first priority before logging them onto the tracking system. Logging on would not be left to technicians.
- Three dispensers must occupy the three dispensing stations most of the time. This was the key intervention. Since nearly 70 per cent of all dispensing was going through the robot, if no one was operating it, no dispensing was occurring.
- Dispensary pharmacists would leave problem prescriptions until all non-problematic prescriptions available to them had been clinically checked and logged on by them.
- Problem prescriptions would be dealt with as follows: those with ward locations would be annotated to the ward; those without a location would be put to one side until a message was left in the pharmacy enquiring about it; complex clinical enquiries would be dealt with via the prescriber — the ward clinical pharmacist would be alerted if the problem had not been rectified.
- Unnecessary interruptions were dealt with by introduction of a dispensary telephone answering machine, pagers for clinical pharmacists of all grades and a ward accessible prescription tracking system (which was available on the stock control system).
- Dispensers were encouraged to follow a first-come, first-served approach and to abandon unnecessary prioritisation of outpatient prescriptions and those requiring transport to other locations not on the main hospital site, unless a routine afternoon delivery was not scheduled.
- The dispensary aims to close at 5.30pm.

There are other advantages to the new dispensary model. Planning staffing levels between departmental units is easier. Predictable changes in dispensary work patterns make it possible and indeed desirable to reallocate dispensing staff to other activities in the afternoons. It is now easier to allow staff to take time off in the afternoons when requested.

Equally it demonstrates that implementing simple, structured changes aimed at improving workflow and removing wasteful activities can be highly effective in reducing long dispensing times in an acute hospital dispensary without increasing staffing levels or compromising patient safety.

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References